Product Overview
Pyrometers, Accessories, Software

Measuring, controlling, calibration – Complete IR systems

Pyrometers:
- Stationary devices for almost all industrial applications
- Mobile handheld pyrometers for fast temperature monitoring
- High-tech pyrometers for special application solutions

Accessories
- Calibration sources, mounting accessories, protective housing, PID controller, scanner

www.sensortherm.com
Motorized focus optics are integrated in the pyrometer. The focus distance is displayed on the device and changed there or on the PC. Then the optics is focused by motor.

Fixed focus optics have a fixed set focus distance.

Manually adjustable optics are integrated in the pyrometer or designed as fiber optics. They are adjusted to the required measuring distance or focus distance by by moving the optics tube.

The through lens view finder provides upright imagery so that the target under measurement can be viewed visually. For stationary devices, the focus point is found on the sharp adjusted eyepiece, handhelds show the spot size.

The laser targeting light shows a red or green laser dot indicating the center of the measuring field. At the focus point of the optics the laser dot is the smallest.

The color camera module can be used to connect a TV or monitor. A target circle in the TV picture is used for alignment. With the automatic, highly dynamic image brightness adjustment, it is also ideal for process monitoring.

The measuring signal is digitized directly behind the detector and then digitally linearized (Sensortherm development). Measurement parameters, such as the emissivity can thus be calculated digitally in the microcontroller without additional errors, instead of being corrected with analog compensating currents, that are subjects to error. Therefore very high measurement speeds and signal outputs (response time) are reached with high accuracy, both on the serial interface and the analog output.

The optics lenses are optimized according to the infrared range to be measured in the various applications of the industry. 2-color pyrometers use specially calculated achromats to compensate for color errors at the 2 measurement wavelengths.

Detectors convert the infrared energy radiated by the measuring object into a photocurrent. Depending on the application high quality Si, InGaAs, extended InGaAs or PbSe detectors are used. Especially our 2-color pyrometers are equipped with two InGaAs or two Si detectors for accurate wavelength approximation and maximum signal strength.

Detectors

Model Variety in Robust Industrial Housings

Capella
Handheld pyrometers in shock-proof aluminum housing.

Metis / Metis M3 / Metis H3 / Diadem
Cuboidal aluminum housing with integrated optics or as optical fiber version.

Metis HD
Heavy-duty stainless steel measuring system for M3 and H3 pyrometers. For measurements under the harshest conditions in the steel industry.

Sirius / Polaris
Compact stainless steel housing with thread.

Optics Options for the Adapted Object Focusing

Sighting Methods for Simple Measurement Object Detection

Inner Values for Best Performance

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Measuring Temperature

The pyrometer measuring range is selected according to the required temperature of the object.

Material / Spectral Range

The material to be measured largely determines which spectral range of the pyrometer should be selected. For metal measurements, the shortest possible spectral range for a precise measurement is advantageous. Due to technical reasons the beginning of a temperature range may be limited, to a higher starting temperature therefore a model must be selected with a slightly higher spectral range, e.g. longer wavelength.

All devices are equipped with an adjustable emissivity setting for adaptation to the material properties. Some materials are measured in specially rated pyrometer wavelength that have been found by material analysis as suited for this purpose. The field of application is explained by the respective pyrometer models, but also we are pleased to advise you.

Pyrometer Type

Most measuring object temperatures can be determined well with standard 1-color pyrometers. However, in some cases the choice of a ratio pyrometer (2-color pyrometer) may be required, which simultaneously measures in two spectral ranges and determines the temperature by quotient formation. The common use of such devices is at measurements through polluted viewing glasses or strong smoke or dust exposure in the field of view or at measuring objects that are smaller than the pyrometer’s spot size.

The choice of the optics also plays an important role. Optics with adjustable focus distance can be set to different measuring distances, then the spot size is always as small as possible. For measurements in the defocused area, the temperature of a larger measuring surface is determined; the accuracy of the measurement is the same.

The distance ratio is the ratio of measuring distance to spot size and provides information about the quality of the lens. The larger the value, the smaller spot sizes can be achieved.

Response Time / Exposure Time

For all Sensortherm pyrometers the response time \( t_{90} \) is specified. It indicates the time that the pyrometer needs to reach 90% signal height of a 100% temperature step event. Within the response time two measurements and the complete signal processing will be performed. The shorter the response time of a pyrometer, the faster a measured value is provided to the output. This is particularly important when measuring parts move quickly, or when using a scanner, or if the pyrometer’s measuring value should be used to further system control.

Outputs / Interfaces

All stationary pyrometers are equipped with a standard analog output 0/4-20 mA (selectable) and a serial interface RS232 or RS485. Via interface the pyrometer can be parameterized remotely, or a measurement data evaluation or the entire system can be controlled via PC program or a PLC. The data transmission with RS232 is only possible over relatively short distances, via RS485 very long transmission distances can be realized and multiple pyrometers be connected in a bus system to an interface.

Pyrometers with an integrated PID controller are equipped with a manipulated variable output for direct connection to the heating system.

Handheld devices are read out via USB. In addition, a connection to Profinet / Profibus is possible.

Ambient Temperature

The device temperature must be within the specified limits in order to avoid inaccuracies or failures. At operations outside the ambient temperature the pyrometer must be installed in an appropriate protective housing (accessory).
## Pyrometer Overview

### Metis M3

<table>
<thead>
<tr>
<th>Model</th>
<th>Temperature ranges</th>
<th>Spectral response</th>
<th>Response time $t_{90}$</th>
<th>Smallest spot size</th>
<th>Sighting method</th>
<th>Electrical connections</th>
<th>Model variants</th>
<th>For</th>
</tr>
</thead>
<tbody>
<tr>
<td>M323</td>
<td>50–800°C, 80–1200°C, 100–1500°C</td>
<td>2-2.6 μm</td>
<td>&lt; 1 ms</td>
<td>0.6 mm</td>
<td>Manual focus, motorized focus, fixed focus optics:</td>
<td>2 analog outputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M318</td>
<td>100–700°C, 150–1200°C, 180–1300°C</td>
<td>1.65-2.1 μm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12-pin connector-model (with display and adjustment buttons):</td>
<td></td>
</tr>
<tr>
<td>M316</td>
<td>250–1300°C, 350–1800°C, 400–2500°C, 500–3300°C</td>
<td>1.45-1.8 μm</td>
<td>&lt; 0.4 ms</td>
<td>0.4 mm</td>
<td>Manual focus, motorized focus, fixed focus optics:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M309</td>
<td>550–1400°C, 600–1600°C, 650–1800°C, 750–2500°C, 900–3000°C, 1000–3300°C</td>
<td>0.7-1.1 μm</td>
<td></td>
<td></td>
<td>Fiber optic types:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M313</td>
<td>400–1400°C, 500–2000°C, 800–2500°C, 1000–3000°C</td>
<td>1.27 μm</td>
<td>&lt; 1 ms</td>
<td>0.3 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M308</td>
<td>600–1400°C, 700–1800°C</td>
<td>0.855-0.905</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>M306</td>
<td>900–2500°C</td>
<td>0.575-0.625</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>M322</td>
<td>300–1000°C, 350–1300°C, 500–1800°C, 800–3000°C, 1000–3300°C</td>
<td>1.45-1.65 / 1.65-1.8 μm</td>
<td>&lt; 0.8 ms</td>
<td>0.8 mm</td>
<td>Manual focus and motorized focus,</td>
<td></td>
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<tr>
<td>M311</td>
<td>600–1400°C, 750–1800°C, 900–2500°C, 1000–3000°C, 1100–3300°C</td>
<td>0.75-0.93 / 0.93-1.1 μm</td>
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<td>Fiber optic types:</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>H318</td>
<td>120–520°C, 180–800°C</td>
<td>1.65-2.1 μm</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H316</td>
<td>250–800°C, 300–900°C, 350–1100°C, 400–1200°C, 500–1600°C, 600–1800°C, 700–2500°C</td>
<td>1.45-1.8 μm</td>
<td>&lt; 40 μs</td>
<td>0.4 mm</td>
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</tr>
<tr>
<td>H309</td>
<td>550–1200°C, 600–1400°C, 650–1600°C, 700–1800°C, 750–2500°C</td>
<td>0.7-1.1 μm</td>
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</tr>
<tr>
<td>H322</td>
<td>350–800°C, 400–1200°C, 500–1300°C, 550–1400°C, 600–1600°C, 700–2300°C, 1000–2500°C, 1300–3000°C</td>
<td>1.45-1.65 / 1.65-1.8 μm</td>
<td>&lt; 80 μs</td>
<td>0.8 mm</td>
<td></td>
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</tr>
</tbody>
</table>

1) Adjustable up to 10 s  2) With dynamic adaptation at low signal levels, adjustable up to 10 s

### Metis H3

<table>
<thead>
<tr>
<th>Model</th>
<th>Temperature ranges</th>
<th>Spectral response</th>
<th>Response time $t_{90}$</th>
<th>Smallest spot size</th>
<th>Sighting method</th>
<th>Electrical connections</th>
<th>Model variants</th>
<th>For</th>
</tr>
</thead>
<tbody>
<tr>
<td>H318</td>
<td>120–520°C, 180–800°C</td>
<td>1.65-2.1 μm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H316</td>
<td>250–800°C, 300–900°C, 350–1100°C, 400–1200°C, 500–1600°C, 600–1800°C, 700–2500°C</td>
<td>1.45-1.8 μm</td>
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<td>0.4 mm</td>
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<td></td>
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<td>H309</td>
<td>550–1200°C, 600–1400°C, 650–1600°C, 700–1800°C, 750–2500°C</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>H322</td>
<td>350–800°C, 400–1200°C, 500–1300°C, 550–1400°C, 600–1600°C, 700–2300°C, 1000–2500°C, 1300–3000°C</td>
<td>1.45-1.65 / 1.65-1.8 μm</td>
<td>&lt; 80 μs</td>
<td>0.8 mm</td>
<td></td>
<td></td>
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</tbody>
</table>

1) Adjustable up to 10 s  2) With dynamic adaptation at low signal levels, adjustable up to 10 s
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<th>Sighting method</th>
<th>Electrical connections</th>
<th>Model variants</th>
<th>For</th>
</tr>
</thead>
<tbody>
<tr>
<td>M3F1</td>
<td>600–1300°C 750–1800°C 900–2500°C</td>
<td>0.695-0.93 / 0.93-1.1 μm</td>
<td>10 ms 1) 2)</td>
<td>0.8 (till parallel)</td>
<td>green</td>
<td>as M3</td>
<td>as M3</td>
<td>Flames, sooty</td>
</tr>
<tr>
<td>DI16</td>
<td>250–1400°C 300–1500°C</td>
<td>1.45-1.8 μm</td>
<td>5 ms 2)</td>
<td>1.1 mm</td>
<td>yellow, red</td>
<td>0-10 V</td>
<td>RS485</td>
<td>ITS90 traceability. (Transfer Standard Pyrometer)</td>
</tr>
<tr>
<td>DS09</td>
<td>600–1500°C 700–1800°C</td>
<td>0.7-1.1 μm</td>
<td>5 ms 2)</td>
<td>1.1 mm</td>
<td>yellow</td>
<td>0-10 V</td>
<td>RS485</td>
<td></td>
</tr>
<tr>
<td>DI13</td>
<td>1000–3500°C</td>
<td>1.27</td>
<td>5 ms 2)</td>
<td>1.1 mm</td>
<td>yellow, red</td>
<td>0-10 V</td>
<td>RS485</td>
<td></td>
</tr>
<tr>
<td>MY34</td>
<td>300–1300°C</td>
<td>3.43 μm</td>
<td>100 ms 1)</td>
<td>1.2 mm</td>
<td>green</td>
<td>0/4-20 mA, RS232 or RS485, switching input (manually clear maximum value storage)</td>
<td></td>
<td>Semicond.</td>
</tr>
<tr>
<td>MY45</td>
<td>400–1300°C 500–1500°C 500–2000°C</td>
<td>4.5 μm</td>
<td>100 ms 1)</td>
<td>2.5 mm</td>
<td>green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MY46</td>
<td>80–800°C 100–1000°C 300–1300°C 500–2500°C</td>
<td>5.14 μm</td>
<td>depends on model 5, 30 or 100 ms 1)</td>
<td>0.8 mm</td>
<td>green, red</td>
<td></td>
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</tr>
<tr>
<td>MY51</td>
<td>0–400°C 0–700°C 0–1000°C</td>
<td>8-14 μm</td>
<td>depend on model 5 or 100 ms 1)</td>
<td>0.9 mm</td>
<td>green, red</td>
<td></td>
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</tr>
<tr>
<td>MY84</td>
<td>50–400°C 300–800°C</td>
<td>8.05 μm</td>
<td>100 ms 1)</td>
<td>2.5 mm</td>
<td>green</td>
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<tr>
<td>MY80</td>
<td>15–100°C 50–250°C</td>
<td>3.95 μm</td>
<td>3 ms 2)</td>
<td>0.7 mm</td>
<td>green</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>C318</td>
<td>180–1300°C</td>
<td>1.65-2.1 μm</td>
<td></td>
<td>1.2 mm (0.4 mm with close-up lens)</td>
<td>green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C316</td>
<td>250–1300°C 350–1800°C 400–2500°C</td>
<td>1.45-1.8 μm</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C309</td>
<td>550–1400°C 600–1600°C 750–2500°C 900–3000°C 1000–3300°C</td>
<td>0.7-1.1 μm</td>
<td>&lt; 1 ms 3)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>C322</td>
<td>300–1000°C 350–1300°C 500–1800°C</td>
<td>0.75-0.93 μm / 0.93-1.1 μm</td>
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<tr>
<td>C311</td>
<td>600–1400°C 750–1800°C 900–2500°C</td>
<td>1.45-1.65 μm / 1.65-1.8 μm</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>M318</td>
<td>from 100°C (see models)</td>
<td>1.65-2.1 μm</td>
<td>1 ms 2)</td>
<td>as M3</td>
<td>green</td>
<td>Fiber optic types:</td>
<td>as M3</td>
<td></td>
</tr>
<tr>
<td>M316</td>
<td>from 100°C (see models)</td>
<td>1.45-1.8 μm</td>
<td>1 ms 2)</td>
<td>as M3</td>
<td>green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M309</td>
<td>from 100°C (see models)</td>
<td>0.7-1.1 μm</td>
<td>1 ms 2)</td>
<td>as M3</td>
<td>green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H318</td>
<td>from 120°C (see models)</td>
<td>1.65-2.1 μm</td>
<td>&lt; 40 μs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H316</td>
<td>from 120°C (see models)</td>
<td>1.45-1.8 μm</td>
<td>&lt; 40 μs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H309</td>
<td>from 120°C (see models)</td>
<td>0.7-1.1 μm</td>
<td>&lt; 40 μs</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>M322</td>
<td>from 300°C (see models)</td>
<td>1.45-1.8 μm</td>
<td>1 ms 2)</td>
<td>as H3</td>
<td>green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M311</td>
<td>from 300°C (see models)</td>
<td>0.75-1.1 μm</td>
<td>1 ms 2)</td>
<td>as H3</td>
<td>green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H322</td>
<td>from 350°C (see models)</td>
<td>1.45-1.8 μm</td>
<td>&lt; 80 μs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H311</td>
<td>from 350°C (see models)</td>
<td>0.75-1.1 μm</td>
<td>&lt; 80 μs</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>SI23</td>
<td>50–400°C 100–600°C 150–900°C</td>
<td>2-2.6 μm</td>
<td>1 ms 3)</td>
<td>1.3 mm</td>
<td>red</td>
<td>0/4-20 mA, RS232 or RS485, switching input (manually clear maximum value storage)</td>
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</tr>
<tr>
<td>SI16</td>
<td>250–1000°C 300–1300°C 350–1800°C</td>
<td>1.45-1.8 μm</td>
<td>5 ms 1)</td>
<td></td>
<td></td>
<td>RS232 or RS485, 2 switching outputs (transistor)</td>
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<tr>
<td>SS09</td>
<td>550–1400°C 650–1800°C</td>
<td>0.7-1.1 μm</td>
<td>5 ms 1)</td>
<td></td>
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<tr>
<td>PI16</td>
<td>250–1000°C 300–1300°C 350–1800°C</td>
<td>1.45-1.8 μm</td>
<td>4 ms 1)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>PS09</td>
<td>550–1400°C 650–1800°C</td>
<td>0.7-1.1 μm</td>
<td>4 ms 1)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

1) Adjustable up to 10 s  2) With dynamic adaptation at low signal levels, adjustable up to 10 s  3) With dynamic adaptation at low signal levels
**System Solutions**

Additional components for system integration expand the application possibilities of pyrometers.

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### Temperature Indicators

The external temperature **digital display IF00** is mounted where the display of the measuring temperature makes sense. 4 switching outputs can be used as limit value output, they switch the respective output at a definable switching value. In addition, all pyrometer parameters can be set via the device buttons. A separate interface connection also allows communication with a PC.

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### PID Program Controller

Regulus RF and RD (for installation or in a compact desktop housing) are **programmable PID temperature controllers** used for the intelligent control of heating processes. With a combination of pyrometer and program temperature controller:

- temperature changes on inductively heated components can be detected very quickly
- a continuously adjusted control variable for controlling the high-frequency generator is set to the output

The device can also communicate with external controllers via digital inputs and outputs.

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### 4 Zones Line Scanner

**Galaxy line scanners** are used for continuous scanning of measurement objects and always detects the temperature on a line.

This results in temperature profiles of the workpieces, which provide information on temperature peaks, relevant details and possible weak points on slabs, billets or steel strips.

Up to 4 individual scan areas can be defined and evaluated separately.

In harsh environments, the scanner is used in the heavy cooling housing.

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### Calibration Systems

Our **calibration systems** form a communicative unit of calibration source, connection for infrared measuring device and PC as well as a comprehensive software package.

- **Our calibration sources** are highly accurate and extremely temperature-homogeneous reference radiation sources that are used to check infrared measuring devices. They form the communication and connection center.

- **Pyrometers** are supplied by the calibration source with voltage.
  - If necessary, Metis series pyrometers to be checked can also be readjusted, i.e. adjusted so that the measurement deviations are within specifications.
  - With a Diadem Transfer Standard Pyrometer, the calibration source can be adjusted pyrometrically fully automatically.

- The **calibration and adjustment software** communicates with calibration source, pyrometers, thermocouples and takes care of everything:
  - **pyrometer check**, **pyrometer adjustment**, **calibration source calibration**, creation of **calibration** and **adjustment certificates**.

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### Accessories

Just as important as the right pyrometer is a stable mounting, protection against environmental influences and a secure electrical connection.
All devices operate autonomously. Included in scope of delivery we supply software specially adapted to our devices. Our software further extends the functionality and thereby allows solutions of special measuring tasks.

**Software SensorCal3** is a software for checking and readjustment of the calibration sources CS1500 and CS500-N as well as for checking and readjusting Sensortherm pyrometer types Metis MS / MI / MB / MP and Metis M3.

- **Mode for fully automatic checking and adjustment.**
- **Manual mode for the most accurate adjustments by comparison with the Transfer Standard Pyrometer Diadem or any reference pyrometer or on any calibration sources.**

The line scanner Galaxy steer the pyrometer field continuously back and forth, thus enabling a linear line recording of measured values with recognition of critical temperature ranges.

- In **GalaxyWin** scan speed, scan angle and various scan zones can be defined.
- All measurement data are stored automatically.
- **GalaxyView** is an included 2D and 3D image viewer software to illustrate and print recorded data graphically in 2 or 3 dimensions.
Quality Control

All assemblies are subjected to extensive testings before mounting and ready for shipping:

- Circuit board scan for assembly error detection
- Electrical function test of electronic components
- Microscopic examination of the optical components
- Initial functional testing of the assembled unit
- Climate chamber heating
- Vibration test
- Re-function test with check for deviations from the initial test
- 48-hour long time test

After all tests are passed, the pyrometers are checked again on calibration sources at predetermined temperatures.

- A factory certificate is enclosed with all our pyrometers. It confirms the full functionality and traceability to national standards.

Now the devices are ready for delivery.

We are certified according to DIN EN ISO 9001:2015

Services

- Regular pyrometer maintenance / calibration
- Creation of factory certificates indicating the measurement deviation
- Device readjustment at measured value deviations, incl. factory certificate
- Creation of factory certificates at standard temperature measuring points or with self-defined or additional ones
- IEC 17025 calibration certificates at standard temperature measurement points or with self-defined or additional ones
- Advice to measurement problems, if necessary on-site
- Support at commissioning
- Quick repairs

Individual Advice

The non-contact temperature measurement with pyrometers is the contact measurement superior in many areas. However, often questions arise that can not be solved due to lack of experience. There is the spectral range that must be selected suitable to the material, the response time to the speed of a passing material or any interference at the site of installation has to be considered.

Let advise you individually when the measurement task raises too many questions. We are interested in the long and trouble-free operation of our products at your measurement tasks.

Made in Germany / International Sales

Sensortherm infrared measurement and control GmbH in Sulzbach/Ts. is one of the technology leaders in digital pyrometer technology. Especially our 2-color pyrometers which are the world’s fastest devices with digital output signals.

With more than 30 years of experience in development and production of infrared radiation thermometers, Sensortherm is constantly setting new standards in the digital pyrometry. Sensortherm provides its customers advanced economical and technical solutions from a single source.

All pyrometers and thermal imaging systems are manufactured by Sensortherm “Made in Germany” at our headquarter in Sulzbach / Taunus. Our international sales contacts can be found across the globe, they are listed on our website www.sensortherm.com.

Sensortherm reserves the right to make changes in scope of technical progress or further developments.

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